Additional Analysis for Bus Base North

As requested by the Canyon Park Business Center Owners' Association (CPBCOA)
Provided by Sound Transit and its consultant team at WSP

AutoTURN Analysis:

CPBCOA requested AutoTURN analysis of all primary intersections within the Park affected by potential BBN bus traffic, and at CPBC signals onto SR 527.

AutoTURN analysis was conducted assuming a BUS-45 (most conservative turning radius) for the following turning movements:

- Northbound 17th Avenue SE to eastbound 220th Street SE
- Westbound 220th Street SE to southbound 17th Avenue SE
- Eastbound 220th Street SE to northbound 20th Avenue SE
- Southbound 20th Avenue SE to westbound 220th Street SE
- Westbound 214th Street SE to northbound SR 527
- Westbound 214th Street SE to southbound SR 527
- Northbound SR 527 to eastbound 214th Street SE
- Southbound SR 527 to eastbound 214th Street SE

These movements all can currently be accommodated without any widening of the roadways/intersections or other improvements, such as cutting back curb returns or modifying medians. See Figures 1, 2, and 3, below

Figure 1. Autoturn analysis at 17th Avenue SE and 220th Street SE

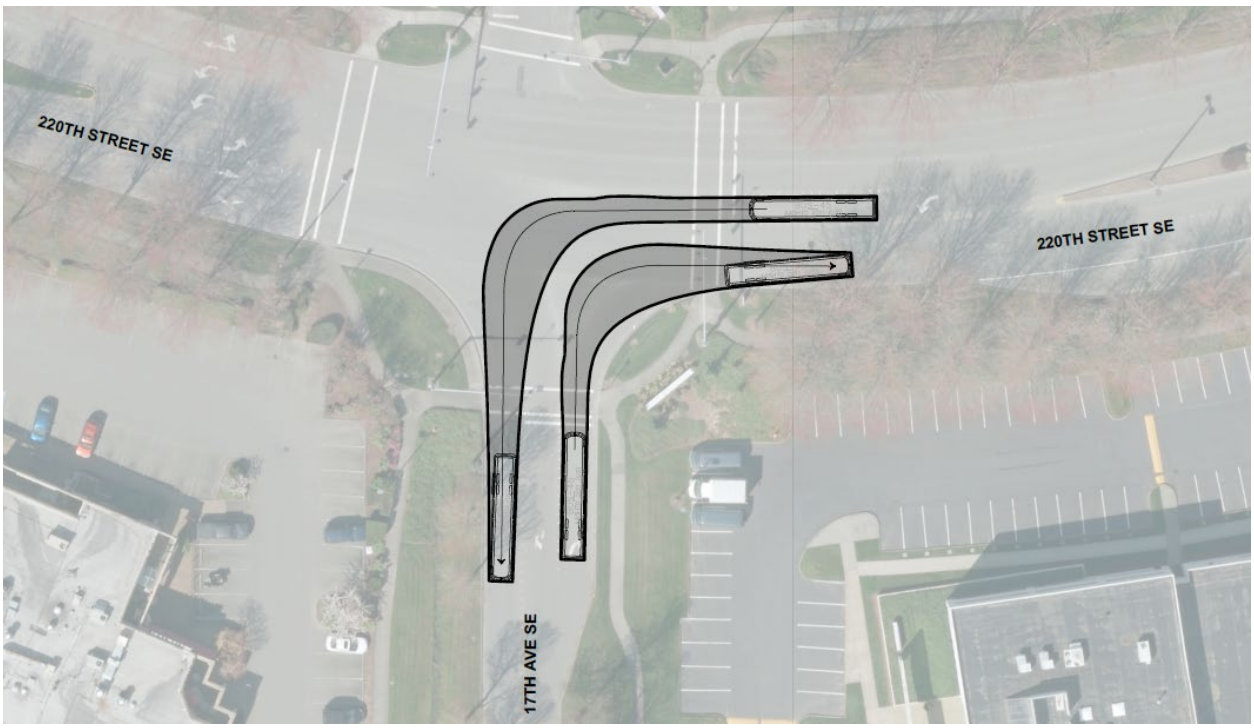


Figure 2. Autoturn analysis at 220th Street SE and 20th Avenue SE

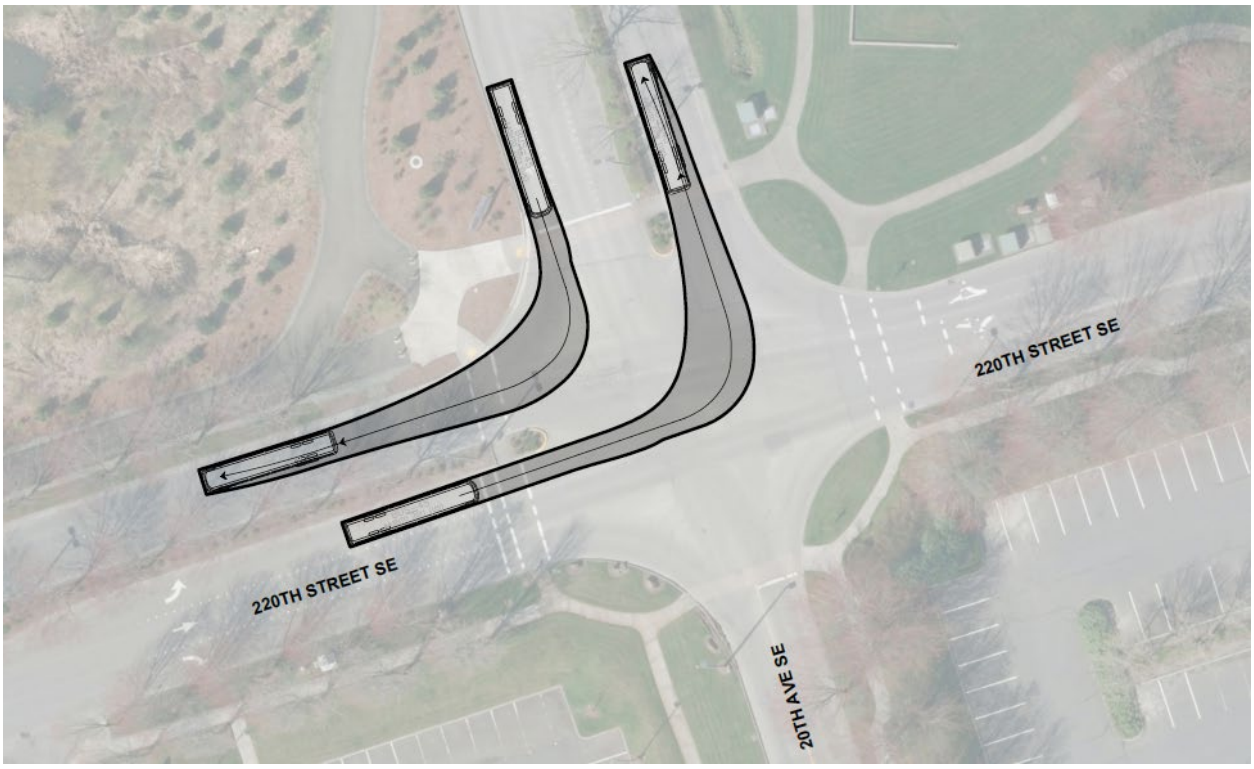
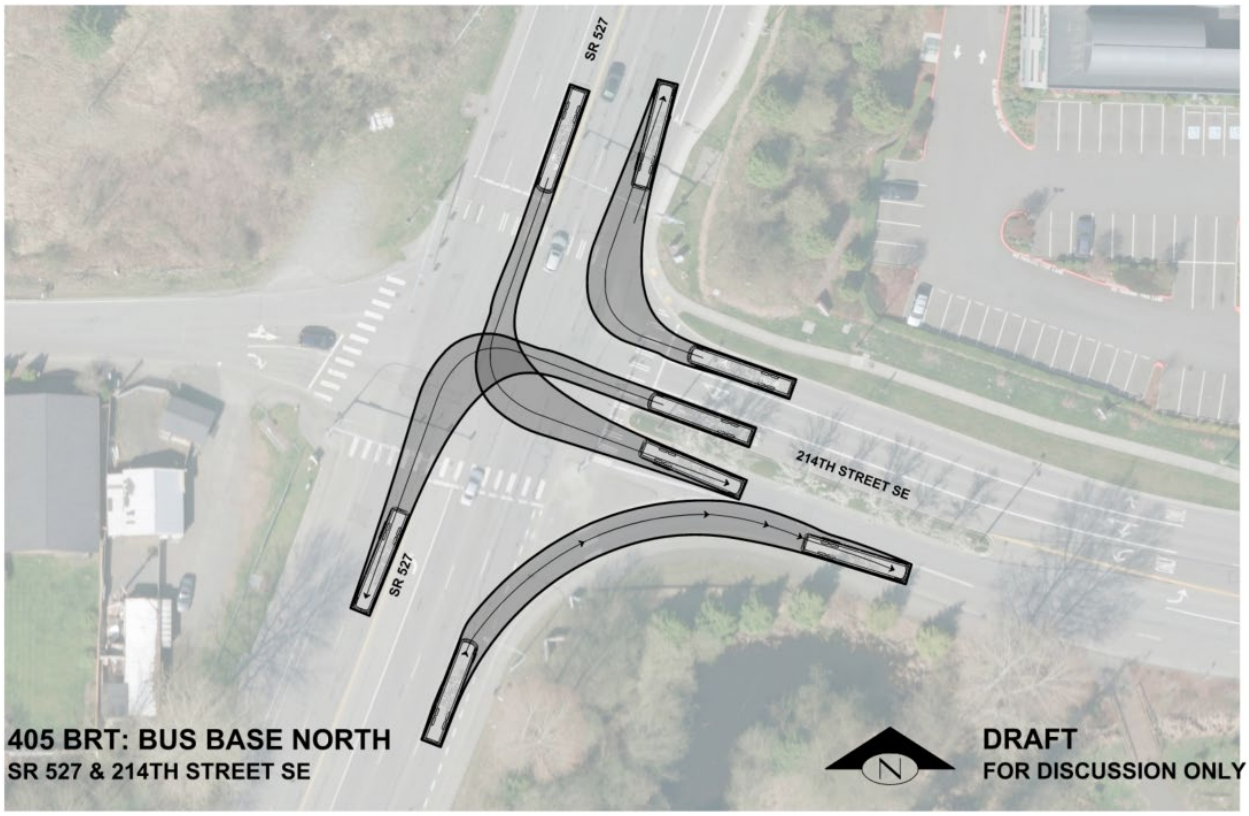


Figure 3. Autoturn analysis at SR 527 and 214th Street SE



Driveway Conflict Information:

CPBCOA requested additional information regarding the access driveway from 20th Ave. SE into the Bus Base North site, including turning movements and Level of Service (LOS).

Sound Transit notes that the turning movements into the Bus Base North site shown in Figure 2-3 of the Transportation Report (Site Vehicle Circulation Plan) show turning envelopes for WB-62 vehicles, the largest vehicles ever expected to enter the site. An updated turning envelope diagram is attached. It shows the turning envelopes for the largest articulated BRT buses (60') that will use the base. It also shows the proposed modification to the existing center median to provide a dedicated left-turn lane into the bus base for vehicles southbound on 20th Ave. SE (see Section A, on the figure). This updated diagram confirms that buses will be able to enter the site using only one travel lane; they will not block the additional travel lane. Buses leaving the site would require more than a single lane to enter the roadway, but they would enter only when the intersection is clear of traffic.

The updated figure also shows that the average queue length (Q_{avg}) for buses entering the site will be 0 feet from either direction. Within the bus base site, there is room for at least four buses to queue prior to the security gate house. For passenger vehicles entering the site, the Q_{avg} = 0 ft and LOS is A. Passenger vehicles exiting from the bus base will encounter a Q_{avg} = 11 ft and a Q_{95} 34', all of which will occur within the bus base site (not on the roadway).

Peak hour traffic levels to and from the bus base would be expected to remain the same whether the WSDOT ETL direct access ramp is completed, as all regular trips during those traditional peak periods would be employees or deliveries that are assumed to access the facility via local streets or I-405 (general purpose lanes). There would be less than one second of overall delay to the driveway intersection in the 2025 AM peak, with 9 seconds of delay of westbound vehicles exiting the facility. Similarly, there would be less than one second of overall delay to the intersection for the 2025 PM peak with 13 seconds of delay to westbound vehicles exiting the facility. (See Figure 4, Entrance Drive).

Bus volumes, LOS, and Intersection Delays:

CPBCOA requested additional information regarding bus volumes, level of service (LOS) and delay at the intersection of 20th Ave SE and SE 220th Street and at the two intersections with SR 527 (214th Street and 220th Street).

No regular inbound or outbound bus movements are expected to occur during the traditional AM or PM peak hour periods for Bus Base North. A key assumption for the traffic forecasting and analysis is that all necessary BRT coaches will be deployed into service prior to the traditional AM peak hour. Similarly, during the PM peak hour, no BRT coaches are expected to enter or leave the Bus Base North site since the required fleet would be in service at that time.

Table 1: Intersection LOS, 2024 AM/PM Peak Hour No Build vs. Build

ID	Intersection	AM Peak				PM Peak			
		2024 No Build		2024 Build		2024 No Build		2024 Build	
		Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
2	**SR 527 and 214th St SE (WSDOT)**	**25**	**C**	**25**	**C**	**34**	**D**	**34**	**C**
4	**SR 527 and 220th St SE (WSDOT)**	**37**	**D**	**37**	**D**	**54**	**D**	**54**	**D**
17	17th Avenue SE and 220th Street SE	12	B	12	B	22	C	22	C
20	**20th Avenue SE and 220th Street SE**	**52**	**F**	**52**	**F**	**145**	**F**	**145**	**F**

SOURCE: Sound Transit 2020
NOTE: LOS = level-of-service; WSDOT = Washington State Department of Transportation

With the I-405 direct access ramp in operation, buses into and out of Bus Base North would have the option to travel on 17th Avenue SE, 220th Street SE and 20th Avenue SE, rather than on SR 527. At the 20th Avenue SE/220th Street SE intersection, approximately 102 inbound (eastbound left) and 102 outbound (southbound right) bus movements would occur over the course of a typical weekday. Outbound bus volumes (toward I-405) would be concentrated (with 62 buses) between 4:30 a.m. and 6:30 a.m. with an additional surge of 32 buses between 2:30 p.m. and 3:30 p.m. Inbound bus volumes would be largely concentrated (with 65 buses) between 11:30 a.m. and 1:30 p.m. with an additional surge of 32 buses between 11:30 p.m. and 12:30 a.m.

Intersection Queue Lengths:

CPBCOA requested additional information regarding queue lengths for buses (and GP traffic) turning (left) from SE 220th Street to 17th Ave SE by time of day and to/from 214th and 220th to SR 527 when ETL ramp not in place.

No Sound Transit buses are expected to enter or leave the Bus Base North site during the traditional peak periods. However, existing Community Transit routes, specifically the 105, 120, and 435 would be expected to continue using the 220th Street SE/17th Avenue SE intersection during peak hours. SimTraffic analysis for future 2024 Build conditions shows average queue lengths for the westbound-to-southbound left turn movement of 50-60 feet for the AM peak and 40-50 feet for the PM peak. The 2025 analysis also shows 95th percentile queues of 110-120 feet during the AM peak hour and 80-90 feet for the PM peak hour. The current left turn pocket at this intersection shows a length of approximately 110 ft (measured from Google Earth maps).

If the I-405 direct access ramp is not in place, buses would use 214th Street SE and State Route 527 to travel to and from I-405, in lieu of 17th Avenue SE and the proposed direct access ramps. SimTraffic analysis for future 2024 Build conditions (with no direct access ramps) shows average queue for the 214th Street SE to SR 527 westbound left turn of 10-20 feet for the AM peak and 40-50 feet for the PM peak. The 95th percentile queue for the same left turn movement is estimated at 50-60 feet for the AM peak hour and 80-90 feet for the PM peak hour. For the reverse, northbound right turn movement from SR 527 to 214th Street SE, only minimal queues are expected to develop (less than 50 feet) during either the AM or PM peak hour.

Additional SimTraffic analysis for 220th Street SE/SR 527 shows average westbound left queues of 150-160 feet for the AM peak and 200-210 feet for the PM peak. The 95th percentile queue for the same left turn movement is estimated at 230-240 feet for the AM peak and 275-285 feet for the PM peak. For the reverse, northbound right turn movement from SR 527 to 220th Street SE, average queues are estimated at 50-60 feet (AM peak) and 120-130 feet (PM peak). For this movement, 95th percentile queues of 170-180 feet (AM peak) and 250-260 feet (PM peak).

As with the direct access routing, no Sound Transit buses are expected to enter or leave the Bus Base North during these peak hours.

A summary table regarding modeled queue lengths and existing storage length is provided below.

			AM Peak				PM Peak			
			2024 Build				2024 Build			
ID	Intersection name	Movement	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Change from No Build	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Change from No Build
2	SR 527 and 214th Street SE	Westbound left	19	56	300' plus an additional 100' after the driveway.	Negligible; the Project only adds 3 vehicles to this movement in the AM peak hour.	42	84	300' plus an additional 100' after the driveway.	Negligible; the Project only adds 10 vehicles to this movement in the PM peak hour.
4	SR 527 and 220th Street SE	Westbound left	156	232	230	None	204	281	230	None
17	17th Avenue SE and 220th Street SE	Westbound left	54	113	110	None	45	85	110	None

LOS/Delays at 214th Street / SR 527:

CPBCOA requested information regarding LOS and delays at the traffic signal at SE 214th Street/SR 527, in the event that construction of the ETL ramp is delayed beyond the opening of the bus base.

Since no buses would be traveling into or out of the Bus Base North site during the traditional peak hours, the LOS and delay would remain unchanged (see **Table 1**). The bus volumes and hourly distribution would be the same as described in the text associated with that table.

Qualitatively, the highest volume of buses leaving the facility would be between 4:30 a.m. and 5:30 a.m. with 36 outbound buses. This would be an average of one bus every 1 minute 40 seconds, which is the approximate cycle length of the 214th Street SE/SR 527 intersection. Therefore, there would be approximately one outbound bus per cycle at this intersection. Given that traffic volumes are generally low from 4:30 a.m. to 5:30 a.m., this additional bus per signal cycle would have a negligible effect on general purpose traffic delays or queuing.

For buses entering the facility, the highest volume hours would be from 11:30 a.m. to 12:30 p.m. and 12:30 p.m. 1:30 p.m., with 33 buses and 32 buses, respectively. This would add slightly less than one bus per signal cycle to existing traffic levels during non-peak times. While the background traffic during midday would be more substantial than during the early morning outbound period, the additional bus per signal cycle would result in modest changes to general purpose traffic delays or congestion.

The results would also be the same, if buses were to operate south on 20th Ave SE to 220th, then to SR 527 to I-405.

Intersection LOS at 220th and 20th:

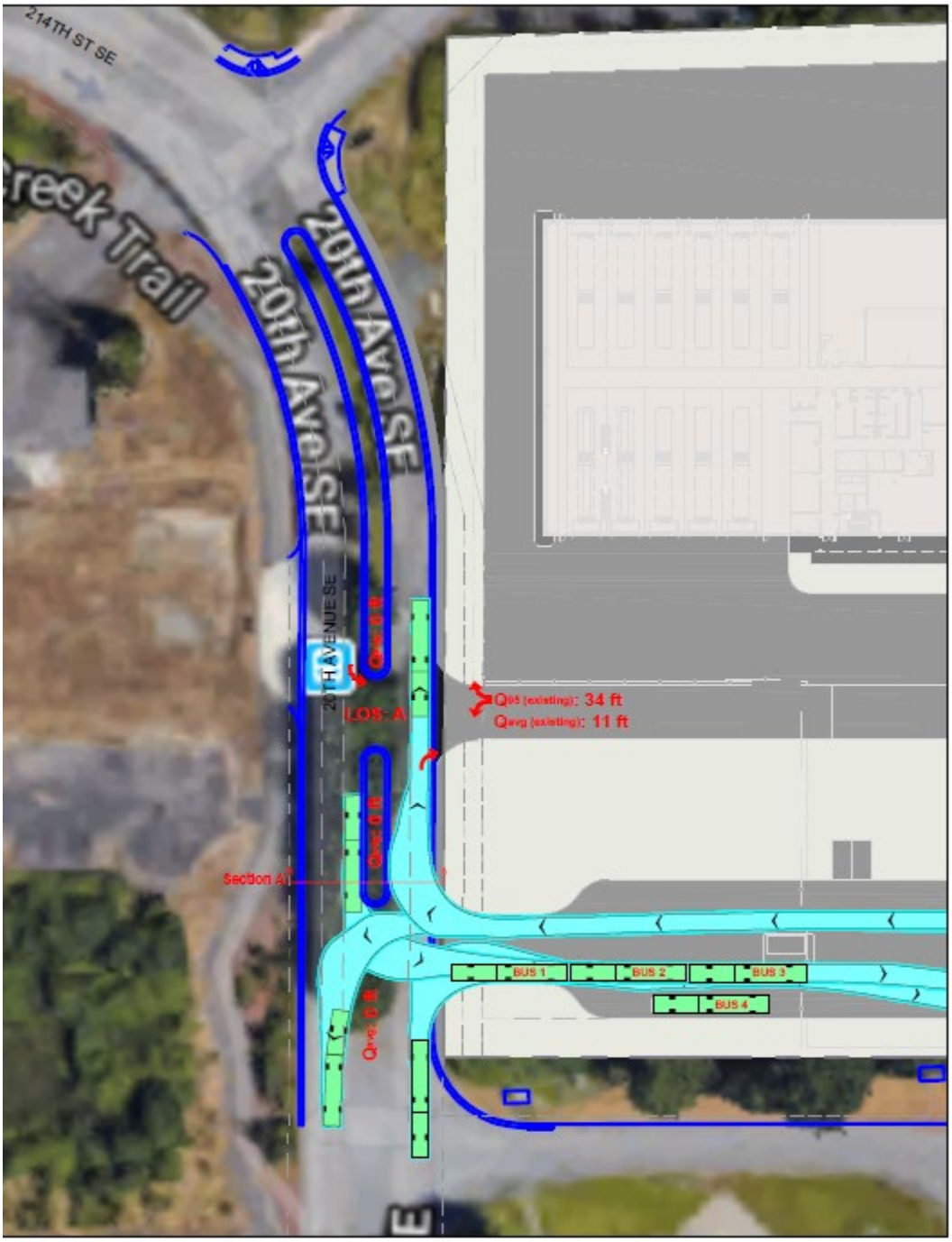
CPBCOA requested information regarding LOS at the 20th/220th intersection and the effect of signalization versus all-way stop-controlled (AWSC).

Because of the operating characteristics of the bus base, buses would not add noticeable delays at the intersection of 20th Avenue/220th Street. A signal would perform substantially better than stop control at the intersection as shown in **Table 2**. The signal was analyzed with no changes to the roadway geometry or lane assignments. Because of shared lanes, the existing roadway would require a split phase for north/south traffic. Changes to the roadway geometry, particularly a northbound left-turn lane, could be expected to further improve intersection performance.

Table 2: Intersection level-of-service, 2024 AM/PM Peak Hour AWSC vs. Signal

ID	Intersection	AM Peak				PM Peak			
		2024 AWSC		2024 Signal		2024 AWSC		2024 Signal	
		Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
20	20th Avenue SE and 220th Street SE	52	F	18	B	145	F	46	D

Figure 4 Bus Base North Entrance Drive



Section A: